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10/693,373

10/24/2003

Yan Borodovsky

P17484

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10/06/2008

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EXAMINER

CHACKO DAVIS, DABORAH

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

|                              |   |  |  |
|------------------------------|---|--|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/693,373    | <b>Applicant(s)</b><br>BORODOVSKY, YAN |  |
|                              | <b>Examiner</b><br>DABORAH CHACKO DAVIS | <b>Art Unit</b><br>1795                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 08 September 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-13,25-27 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 25-27 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                       | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>09/08</u>   | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 10-12, are rejected under 35 U.S.C. 102(b) as being anticipated by EP 0915384 (Sugita et al., hereinafter referred to as Sugita).

Sugita, in [0018], [0019], [0020], [0021], [0022], [0023], [0038], [0064], [0065], [0066], [0091], [0092], discloses exposing a photoresist coated wafer to an interference patterns in an interference exposure apparatus, to form a periodic pattern (line and space pattern, an exposed array of patterns), performing a second exposure in a different apparatus different from the interference exposure apparatus to form a pattern on the photoresist with a pitch twice as large as the first pitch (pitch of the interference pattern). Sugita, in [0113], discloses that an alignment optical system is utilized to observe an alignment mark and detect the position thereof and that the position of the stage is controlled by means of a laser interferometer. Sugita, in [0105], discloses that the second linewidth is less than that of the first line width (claims 10 and 11). Sugita, in [0090], and [0091], discloses that the pitch of the interference pattern is about half wavelength (claims 12).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-3, 5, 7, and 25-27, are rejected under 35 U.S.C. 103(a) as being unpatentable over EP 0915384 (Sugita et al., hereinafter referred to as Sugita) in view of U. S. Patent No. 5,415,835 (Brueck et al., hereinafter referred to as Brueck).

Sugita, in [0018], [0019], [0020], [0021], [0022], [0023], [0038], [0064], [0065], [0066], [0067], [0091], [0092], and in figures 15, and 19, discloses exposing a photoresist coated wafer to an interference patterns in an interference exposure apparatus (collimated and expanded laser beams, the light source is a laser), to form a periodic pattern (line and space pattern, an exposed array of patterns i.e., for positive resists unexposed lines and exposed spaces are produced), performing a second exposure in a different apparatus different from the interference exposure apparatus to form a pattern on the photoresist with a pitch twice as large as the first pitch (pitch of the interference pattern). Sugita, in [0113], discloses that an alignment optical system is utilized to observe an alignment mark and detect the position thereof and that the position of the stage is controlled by means of a laser interferometer. Sugita, in [0073], and [0105], discloses that the second linewidth can be less than that of the first line width. Sugita, in [0021], [0022], discloses that the second exposure can be performed with masks having different patterns (claims 1, 3, and 25-26). Sugita, in [0026],

Art Unit: 1795

discloses that the second exposure can be a lens-based lithography (projection lens) (claim 27). Sugita, in [0064], [0065], and in figures 2A, and 2B, discloses that the first line width and second linewidth are equal (claim 2). Sugita, in [0087], [0088], and in figure 16, discloses a beam splitter (claim 5). Sugita, in [0103], discloses that the second apparatus is a mask-based lithography tool (claim 7). Sugita, in [0113], [0114], [0116], discloses an alignment optical system (alignment sensor) that observes the alignment mark on the wafer for the interference pattern formed in the first exposure, and observes the alignment mark on the wafer (with interference pattern formed) for the projection exposure process (second patterning system) performed on the exposed wafer. Sugita, in [0115], and in figure 21, discloses a system that enables the interference exposure apparatus (first patterning system) and the projection optical exposure apparatus (second patterning system, imprint system) to perform a first and second exposure on the wafer via a reticle to form a reduced pattern on the wafer positioned on the wafer stage.

The difference between the claims and Sugita is that Sugita does not disclose using the alignment system to align the lines that are remaining unexposed to radiation (from the first exposure) to trim and narrow the first width of at least some of the unexposed lines.

Brueck, in col 2, lines 60-68, and in col 8, lines 40-65, discloses that the second exposure pattern is re-positioned such that the unexposed portions (lines) of the resist from the first interference exposure is exposed during the second exposure and results

Art Unit: 1795

in a second line width that is smaller than the first linewidth (i.e., the second exposure trims and narrows the first width).

Therefore, it would be obvious to a skilled artisan to modify Sugita by using the alignment system to align and perform exposure to non-exposed areas as suggested by Brueck because Sugita, in [0113] that the alignment system is re-positionable to any desired position relative to the alignment mark, and Sugita, in [0074], and [0086], discloses that the resultant linewidth of the interference pattern formed can be reduced further by adjusting the angles at which the light beams are incident on the wafer, and by adjusting the exposure amount distribution.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over EP 0915384 (Sugita et al., hereinafter referred to as Sugita) in view of U. S. Patent No. 5,415,835 (Brueck et al., hereinafter referred to as Brueck) as applied to claims 1-3, 5, 7, 10-12, 25-27 above, and further in view of U. S. Patent Application Publication No. 2005/0028129 (Hsu et al., hereinafter Hsu).

Sugita in view of Brueck is discussed in paragraph no. 4.

The difference between the claims and Sugita is that Sugita does not disclose that the second apparatus uses optical proximity correction on a mask to adjust feature widths (claim 4).

Hsu, in [0012], [0013], [0014], discloses implementing optical proximity correction on the mask (pattern) so as to optimize the settings of critical feature (width, pitch etc).

Therefore, it would be obvious to a skilled artisan to modify Sugita by employing the method of performing OPC adjustments on the mask as suggested by Hsu because Hsu, in [0055], discloses that enhancement of lithographic settings via OPC treatment increases the process window for multiple features.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over EP 0915384 (Sugita et al., hereinafter referred to as Sugita) in view of U. S. Patent No. 5,415,835 (Brueck et al., hereinafter referred to as Brueck) as applied to claims 1-3, 5, 7, 10-12, 25-27 above, and further in view of U. S. Patent No. 6,946,666 (Saito et al., hereinafter referred to as Saito).

Sugita in view of Brueck is discussed in paragraph no. 4.

The difference between the claims and Sugita in view of Brueck is that Sugita in view of Brueck does not disclose that the first apparatus includes a diffraction grating (claim 6).

Sugita, in col 23, lines 44-50, discloses that the interference exposure system (first exposure) employs a grating pattern of a known pitch (substantially equal pitch).

Therefore, it would be obvious to a skilled artisan to modify Sugita in view of Brueck by employing a grating pattern as suggested by Saito because Saito, in col 23, lines 44-50, discloses that the interference fringes of the two light beams are recorded on the wafer based on the grating pattern provided in the interference exposure system, and Sugita in [0069], discloses that an exposure pattern of high resolution is formed due to the mixing of the dual-beam interference exposure and the projection exposure.

Art Unit: 1795

7. Claims 8-9, are rejected under 35 U.S.C. 103(a) as being unpatentable over EP 0915384 (Sugita et al., hereinafter referred to as Sugita) in view of U. S. Patent No. 5,415,835 (Brueck et al., hereinafter referred to as Brueck) as applied to claims 1-3, 5, 7, 10-12, 25-27 above, and further in view of U. S. Patent No. 5,041,361 (Tsuo).

Sugita in view of Brueck is discussed in paragraph no. 4.

The difference between the claims and Sugita in view of Brueck is that Sugita in view of Brueck does not disclose that the second exposure apparatus or the second patterning module includes an electron beam tool (claim 8). Sugita in view of Brueck does not disclose that the second apparatus comprises a maskless optical lithography tool with a database (claim 9).

Tsuo, in col 2, lines 59-68, in col 3, lines 1-12, and lines 36-42, in col 4, lines 18-21, discloses that the exposure apparatuses include an electron beam lithography tool, an X-ray lithography tool, and ion beam systems. Tsuo, in col 3, lines 1-5, in col 10, lines 25-30, discloses that the exposure system includes a maskless exposure system and includes a direct write module such as an ion beam module (ion beam source), or an electron beam module (focused electron beam), and that the direct write module includes a database (connected to a computer).

Therefore, it would be obvious to a skilled artisan to modify Sugita in view of Brueck by employing the exposure modules suggested by Tsuo because Tsuo, in col 4, lines 14-20, discloses that the using high energy sources such as X-rays, e-beams, and ion beams enables a resistless process to form circuit components directly in the substrate material and eliminates all the resist process steps.



Art Unit: 1795

8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over EP 0915384 (Sugita et al., hereinafter referred to as Sugita) in view of U. S. Patent Application Publication No. 2002/0078427 (Palmer et al., hereinafter referred to as Palmer)

Sugita is discussed in paragraph no. 4.

The difference between the claims and Sugita that Sugita does not disclose that the mask is generated from the Boolean subtraction of the final design layout from the interference pattern (claim 13).

Palmer in [0022], [0023], discloses that a Boolean subtraction of the bounded contour and the initial input is performed to obtain the mask layout.

Therefore, it would be obvious to a skilled artisan to modify Sugita by performing a Boolean subtraction to the initial input mask data and the bounded data set as suggested by Palmer because Palmer in [0023], discloses that performing a Boolean operation enables the designer to adjust the original layout or adjust the proximity correction attributable to a particular feature that is otherwise overstated in size by too large of a degree or reduced in size or completely omitted.

### ***Response to Arguments***

9. Applicant's arguments filed September 8, 2008, have been fully considered but they are not persuasive. The 102 and 103 rejections made in the previous office action (paper no. 20061124) are maintained. The amendments presented do not change the scope of the claims i.e., for example, changing lines and spaces to alternating lines and

Art Unit: 1795

spaces, and changing "trim and narrow the first width" to "preserve the first width, narrow the first width or break the continuity" does not change the scope of the claims (claims filed 02/28/2007). These arguments were addressed in the Examiner's answer, and affirmed at the BPAI (07/11/2008).

A) Applicants argue that Sugita does not disclose that second linewidth of the features can be narrower than the first linewidth of the unexposed line pattern, and that Sugita does not disclose forming lines with a first width.

Sugita discloses forming a line and space pattern i.e., the first line and space pattern has a first linewidth or width. Sugita, in [0073], and [0105], discloses that the second linewidth can be less than that of the first line width (also see figure 7B). Sugita, in [0021], [0022], discloses that the second exposure can be performed with plural masks having different patterns i.e., unexposed lines of the resist can be exposed during the second exposure.

### ***Conclusion***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent

Art Unit: 1795

Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Daborah Chacko-Davis/  
Examiner, Art Unit 1795

October 1, 2008.